A Survey of Birds in the Area Surrounding Bullmoose Lake Goldmine, Northwest Territories

Environment Canada
Canadian Wildlife

Environnement Canada
Service canadien

A SURVEY OF BIRDS IN THE AREA SURROUNDING BULLMOOSE LAKE GOLDMINE, NORTHWEST TERRITORIES

Habitat Management Section

Technical Report No. 85-5

Bradley D. Arner
and
Guy Verreault

CANADIAN WILDLIFE SERVICE
WESTERN AND NORTHERN REGION
YELLOWKNIFE, NWT

December 1985

ABSTRACT

In late May and early August 1984, surveys of birds were undertaken at the site of a proposed goldmine at Bullmoose Lake, Northwest Territories. The objectives of this study were: 1) to document bird species using the goldmine site, 2) to evaluate the potential effects on waterfowl which stage, feed, and nest in local wetlands, and 3) to recommend measures to minimize the impact of mine development on the local avifauna.

Two observers surveyed the wetlands and lake shorelines within 500 m of the proposed development facilities. Information was collected on the number, age, activity, and location of all bird species; nest records were also compiled.

In total, 54 bird species were observed on the study area. Evidence of breeding was recorded for 26 of these species. The area does not support large numbers of nesting or staging birds nor does it contain habitat "critical" to the maintenance of any bird population.

Strict compliance with land-use permit conditions will ensure that this development inflicts minimal environmental impact on the avifauna. Also, the productivity of a local Bald Eagle eyrie should be monitored throughout the life of the mine.

TABLE OF CONTENTS

	Page
ABSTRACT	i
LIST OF FIGURES	iii
LIST OF TABLES	iii
LIST OF APPENDICES	iii
ACKNOWLEDGEMENTS	iv
1.0 INTRODUCTION	1
1.1 Background of the Bullmoose Lake Gold Mine	1
1.2 Potential Environmental Impacts	4
1.3 Study Objectives	5
2.0 STUDY AREA	5
2.1 Climate	5
2.2 Physiography	7
2.3 Vegetation	7
3.0 METHODS	9
4.0 RESULTS	10
5.0 DISCUSSION	10
5.1 Spring Migration	10
5.2 Breeding Birds	18
5.3 Anticipated Impacts	20
6.0 SUMMARY AND RECOMMENDATIONS	21
7.0 LITERATURE CITED	22
8.0 APPENDIX	24

LIST OF FIGURES

Figure — Page

1. Location of the study area.....2
2. Proposed mine and associated facilities.....3
3. Watercourses surveyed within the study area.....6
4. Locations of nests found in May and August, 1984.....14
5. Brood sightings in August, 1984 17

LIST OF TABLES

Table — Page

1. Abundance and activities of species observed in May, 1984.....11
2. Number of nests and eggs located in May and August, 1984.....15
3. Number of broods and age of young observed in August, 1984.....15
4. Abundance and activities of species observed in August, 1984.....16

LIST OF APPENDICES

Appendix — Page

1. Bird species observed within the study area.....24

ACKNOWLEDGEMENTS

This study was conducted by the Canadian Wildlife Service at the request of Terra Mines Ltd. of Edmonton which provided all logistical support. The assistance and cooperation of Steve Nicholas and Gary Zander in arranging the transportation and accommodation is appreciated.

Kevin McCormick, Bert Poston, and Lynne Dickson provided valuable comments on the manuscript.

Sue Stephenson typed the manuscript and Denis Valiquette drafted the figures.

Mike Fournier prepared the final manuscript for printing.

1.0 INTRODUCTION

1.1 Background of the Bullmoose Lake Gold Mine

Interest in the gold deposits at Bullmoose Lake (Fig. 1) dates back to the early 1930's when exploration and bulk sampling took place. The ore body is presently being developed into a producing mine by Terra Mines Ltd., the present, 100% owner-operator.

The development will include a 1000 ton-per-day processing mill, storage facilities for 13.5 million litres of fuel, maintenance and office buildings and an accommodation complex for 200 people (Fig. 2). Ten kilometres of all-weather service roads, and a 1525-metre gravel airstrip are being constructed. In total, 24 hectares of forest will be cleared. Airstrip construction requires the partial filling of two lakes. In addition, Doodad Lake will be drained to accommodate a daily production of 1.7 million litres of tailings, sewage, and mine water. Decanted fluids from Doodad Lake will be totally contained in Skeeter Lake (Nicholas 1984). The projected start-up date for the mine is September, 1985.

To date, access to the site has been by a 65-kilometre winter road connecting with Yellowknife via the Ingraham Trail, and by aircraft with approximately 5 weekly flights during the summer.

The Regional Environmental Review Committee (RERC), an advisory body to Indian and Northern Affairs Canada, has requested the proponent to submit an Initial Environmental Evaluation (IEE) of this project. The Canadian Wildlife Service (CWS), a member of RERC and responsible for evaluating potential impacts on migratory birds was, in turn, asked by Terra Mines Ltd. for assistance in assessing the ornithological value of this site.

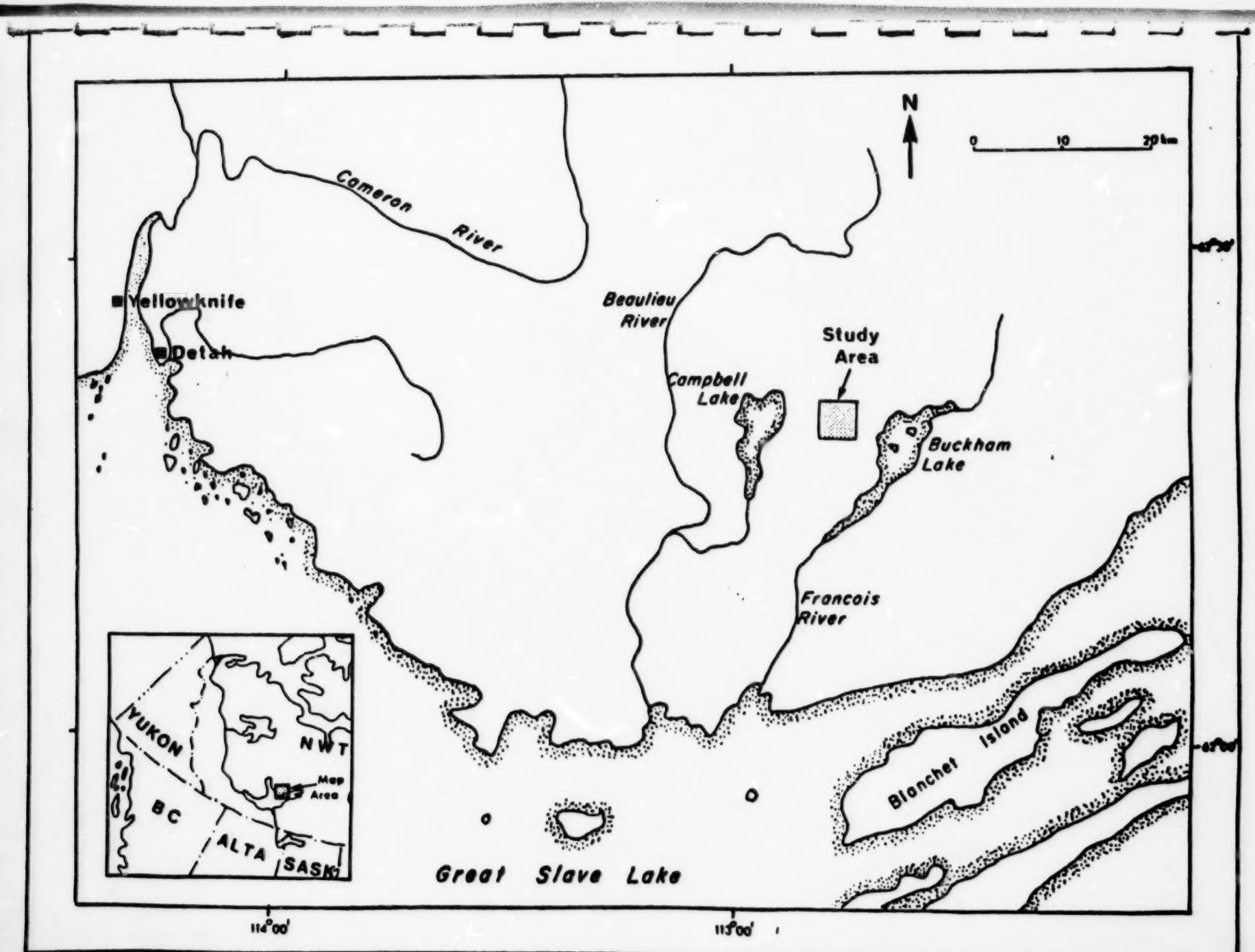

Figure 1. Location of the study area.

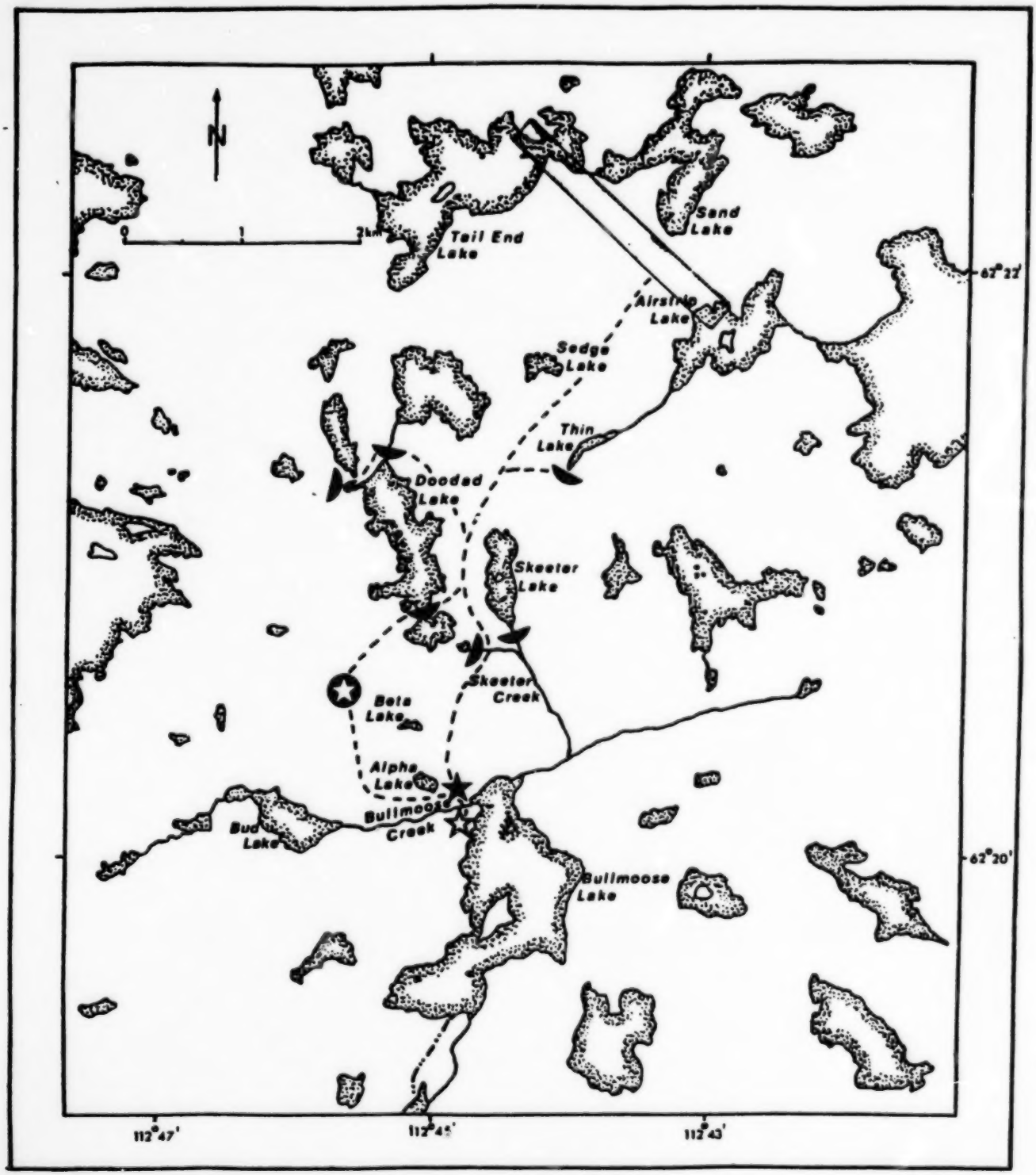

Figure 2. Proposed mine and associated facilities.

☆ - employee housing
★ - mine entrance and fuel storage
✪ - mill site
▬ - earth dams
---- - access road
—·— - winter road
□ - airstrip

1.2 Potential Environmental Impacts

Mining activities, of the presently proposed scale, may result in two major types of impact - degradation of water quality and disturbance of wildlife.

Effluents from other goldmines in the NWT have been found to contain high levels of cyanide, arsenic, lead, zinc, and copper. In all cases, untreated effluent was potentially harmful to fish and other aquatic life (Wallace et al. 1975). Fish near two Yellowknife gold mines had unusually high concentrations of arsenic, zinc, copper, lead, cadmium, and nickel (Falk et al. 1973). Lake trout near Discovery Mine, 90 km north of Yellowknife, contained as high as 12.3 mg/kg of mercury which far exceeds the maximum safe limit of 0.5 mg/kg, recommended by National Health and Welfare (Moore et al. 1978). Birds which feed on benthos and fish in waterbodies where mine tailings are dumped accumulate these heavy metals (Peakall 1976). Spills or seepage from chemical or fuel storage sites and tailings ponds may result in acute toxicity to aquatic life in the immediate area. An accumulation of heavy metals by prey species, in waterbodies downstream, may occur over a longer term.

Construction activities, aircraft, and human activities may result in disturbance to wildlife. The impact of disturbance varies with the species and its distribution as well as the type and timing of the disturbance. Species, and individuals within a population, vary in their sensitivity to disturbances. Raptors may injure young and eggs, and desert nest sites when disturbed in the early stages of nesting (Fyfe and Olendorff 1976). Species which congregate in a particular geographic area during any stage of their life cycle are more vulnerable to site specific disturbances: an example being the many species of waterfowl which congregate on traditional staging and nesting grounds in the NWT. Colonial nesting species are the most vulnerable since an impact on the birds while breeding may have a significant effect on their population numbers (Dzubin 1984).

1.3 Study Objectives

In light of the potential impacts from a mine development, this field study was undertaken to assess the importance of the area to migratory birds.

The objectives of the study were:

1) to document the bird species using the goldmine site.

2) to evaluate the potential effects on waterfowl which stage, feed, and nest on local wetlands.

3) to recommend measures to minimize the impact of mine development on local bird populations.

2.0 STUDY AREA

Bullmoose Lake (62° 20'N, 112° 45'W) is situated 85 km east of Yellowknife in the Francois River drainage system. It occurs approximateley 35 kilometres north of Great Slave Lake (Fig.1) Detah, which is the nearest community, lies 79 km west of the study area. The study area includes Bullmoose Lake and all watercourses within 500 m of any proposed mining activity (Fig.3).

2.2 Climate

There is no climatic data from Bullmoose Lake, however, certain inferences can be drawn from Yellowknife records.

The area experiences a continental climate with short, warm summers and long, cold winters. Mean daily temperatures are above freezing from May to September. The mean daily temperature in Yellowknife for January is -29°C and for July is 16°C (Atmos. Env. Serv. 1982a).

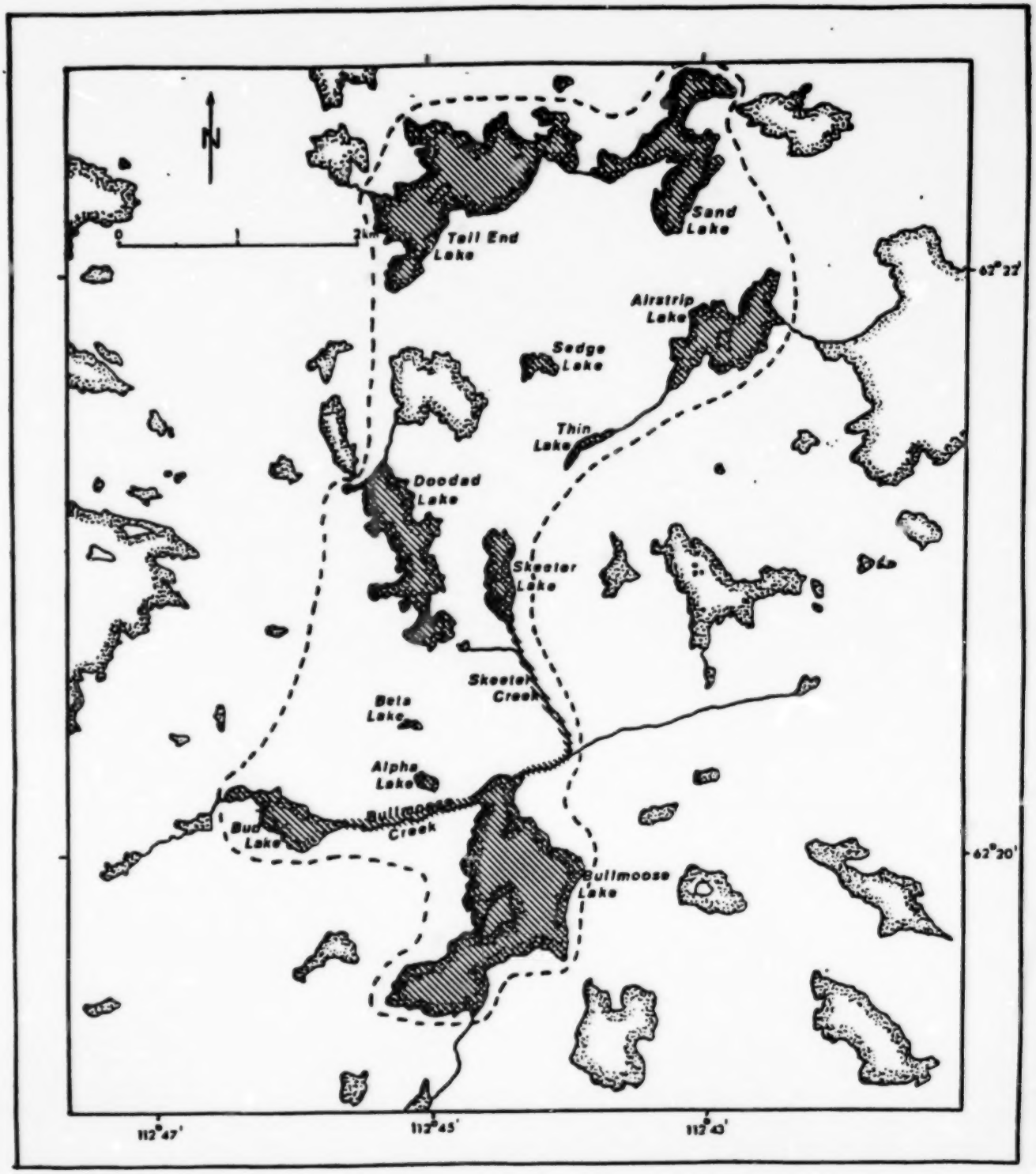

Figure 3. Watercourses surveyed (▨) within the study area (---).

Small waterbodies are ice free by mid-May, and larger lakes are open by early June. In fall, freeze-up begins on the smaller ponds by the first of October and continues on the larger lakes and rivers into November.

The mean annual precipitation is 267 mm which includes a mean annual snowfall of 135 cm (Atmos. Env. Serv. 1982b).

2.2 Physiography

The study area lies within the Bear-Slave Uplands physiographic region of the Precambrian Shield which is typified by rounded, rocky hills and numerous lakes (Bostock 1970). Recent glaciation is confirmed by the predominance of barren rock outcrops, a thin layer of organic soil, and sandy eskers.

In our study area, relief of the gently rolling hills is less than 40 metres. A large sandy esker is located at the northern end of the study area and will be used for airstrip construction. The shallow lakes (4-12 m) contain many islands and are poorly drained.

The area is underlain by altered sediments of the Yellowknife Supergroup: nodulars, schistose greywackes, phyllites, and fine grained mica schists (Nicholas 1984).

2.3 Vegetation

The dominant vegetation is northern boreal forest approaching the forest-tundra ecotone (Thieret 1964). The forest is broken by rock outcrops and numerous lakes and watercourses. Successional vegetation on various-aged burns occurs throughout the region.

Five major vegetation communities, closely linked to the moisture regime, were delineated as follows:

1) jackpine uplands

2) white birch-aspen slopes
3) black spruce bogs
4) sedge-dwarf birch stream valleys
5) shoredge and emergents

1) The uplands, where xeric conditions persist, are dominated by jack pine (Pinus banksiana) in association with white birch (Betula papyrifera). Ground cover consists of lichen, bearberry (Arctostaphylos uva-ursi), rose (Rosa acicularis), soapberry (Sheperdia canadensis), fireweed (Epilobium angustifolium), and mountain cranberry (Vaccinium vitis-idaea).

The sandy esker at the north end of the study area supports scattered jack pine with a mat of lichen and bearberry.

2) At the foot of slopes and ravines with good drainage and deep soil, are young, compact communities of white birch and trembling aspen (Populus tremuloides). The shrub layer consists of green alder (Alnus crispa), crowberry (Empetrum nigrum), mountain cranberry, and scattered white spruce (Picea glauca).

3) Bogs occur in wet areas adjacent to standing water. The open forest of black spruce (Picea mariana) and tamarack (Larix laricina) has a floor of Sphagnum covered by a shrub layer of labrador tea (Ledum groenlandicum), billberry (Vaccinium uliginosum), cloudberry (Rubus chamaemorus), and willows (Salix spp.).

4) Periodically flooded, poorly drained ground of stream valleys supports sedges (Carex spp.), dwarf birch (Betula glandulosa), willows, scattered black spruce, and tamarack.

5) The shoreline of lakes and ponds consists of sweet gale (Myrica gale), leather leaf (Chamaedaphne calyculata), and sedges. These species give way to emergents of horsetail (Equisetum sp.) and bog-rush (Juncus sp.) on sand bottoms, and yellow pond-lily (Nuphar variegatum) in muck-bottomed littoral zones.

Classifications and dominant plant species were confirmed on site and are similar to those of Thieret (1964) for the Yellowknife area.

3.0 METHODS

Historically, the major impact of gold mines has been on water quality, therefore our survey concentrated on local watercourses. On-site data collection was scheduled to coincide with two sensitive phases of the annual cycle of waterfowl - spring migration and breeding. Surveys were conducted on 24-27 May, and 9-10 August, 1984. Two observers surveyed the study area by foot, canoe, or motorized boat (Fig. 3).

In May, shorelines of the following lakes were surveyed by canoe: Bullmoose, Bud, Doodad, and Skeeter. Nest searches were conducted on all associated islands. Alpha, Beta, Thin, Sedge, Airstrip, Sand, and Tail End lakes were surveyed by walking the shoreline. Islands in these lakes were not accessible. Both observers surveyed Bullmoose and Skeeter Creeks on foot.

In August, the shoreline of Bullmoose Lake was surveyed by motorized boat, whereas Sedge, Thin, Alpha, and Beta lakes were surveyed on foot. All other lakes within the study area were surveyed by canoe. Both creeks were surveyed in the same manner as in May. Nest searches were not conducted on islands during this survey.

The northeast arm of Doodad Lake was within the study area, however, due to its inaccessibility, it was not surveyed.

Information collected on each species was: location, number, age, and activity. Waterfowl broods were aged according to size and plumage (Gollop and Marshall 1954).

4.0 RESULTS

Fifty species were observed during the May survey (Table 1) although, in many cases, each species was represented by only one or two individuals. The most common species was Greater Scaup. Four occupied nests were of Mallard(2), Bald Eagle, and Mew Gull; whereas two unoccupied nests were of Bufflehead and an unknown passerine species (Table 2 and Fig. 4). An additional 20 species were suspected of nesting on the study area based on observations of courtship or territorial behaviour.

In August, 27 species were observed (Table 4), many represented by only a few individuals. The most common species was Surf Scoter. Twelve waterfowl broods of Surf Scoter and Scaup and one Bald Eagle eyrie with two young were recorded (Table 3 and Fig. 5). In addition, a brood of Scaup and a brood of Horned Grebes were located outside the study area. Six unoccupied larid nests and a nest of an unidentified species were also found (Table 2 and Fig. 4).

During the two surveys a total of 54 species were observed (Appendix 1). Twenty five breeding records representing six species were collected. The largest concentration of birds was observed on Airstrip Lake on 25 May. The group contained 21 individuals including Ring-necked Ducks, Scaup, Oldsquaws, and White-winged Scoters.

5.0 DISCUSSION

5.1 Spring Migration

The first survey was intended to coincide with the peak of spring migration. However, due to ice conditions, aircraft access was not possible at the appropriate time. Warm temperatures early in May brought about a rapid melt two weeks earlier than normal. On May 24, all ponds and small lakes were ice-free, large lakes (e.g. Buckham Lake) were 60% ice covered and Great Slave Lake was 95% ice covered.

Table 1. Abundance and activities of species observed in May, 1984.*

* Activities were designated as: C-courtship, E-feeding, F-flying, L-loafing, N-nesting, T-territorial behaviour

Species	Bullmoose Lake	Bullmoose Creek	Bud Lake	Alpha Lake	Beta Lake	Doodad Lake	Skeeter Lake	Skeeter Creek	Thin Lake	Sedge Lake	Airstrip Lake	Sand Lake	Tail End Lake
Common Loon	2(L)		2(E)			2(L)							2(T)
Arctic Loon							1(L)						
Red-necked Grebe	1(E)												
Horned Grebe									4(L)				
Tundra Swan	6(F)									9(F)			
Green-winged Teal	2(L)					1(L)							
Mallard		1(N)	1(L)			5(N,L)	1(L)						2(F)
American Wigeon	3(F,L)											1(F)	
Ring-necked Duck						2(L)					2(L)		
Greater Scaup	2(F)		2(F)	2(L)		28(L)			4(L)		10(L)	5(L)	
Lesser Scaup						6(C,F,L)			1(L)				1(L)
Oldsquaw	8(F,L)										2(L)		
Surf Scoter	1(F)					4(L)						4(L)	2(L)
White-winged Scoter	1(F)					2(L)					6(L)		
Scoter sp.				3(F)						1(L)	1(L)		
Bufflehead						5(C,L)							
Red-breasted Merganser	6(E,F,L)									2(F)		2(L)	
Bald Eagle	2(N)					1(F)							
Northern Harrier		1(E)											
Merlin										1(F)		1(E)	
Killdeer	1(T)												
Lesser Yellowlegs						3(F,T)				3(C,L)	3(F,T)		
Sandpiper sp.	1(E)					1(F)							
Bonaparte's Gull	2(C)		2(L)			4(F,L)							

Cont'd...

Table 1. Continued.

Species	Bullmoose Lake	Bullmoose Creek	Bud Lake	Alpha Lake	Beta Lake	Doodad Lake	Skeeter Lake	Skeeter Creek	Thin Lake	Sedge Lake	Airstrip Lake	Sand Lake	Tail End Lake
Mew Gull	3(F)		1(F)			4(F,L,N)	3(F,L)						
Herring Gull		2(F)				1(L)						1(F)	
Arctic Tern	2(E)		2(E)										
Belted Kingfisher		1(E)											
Northern Flicker	2(T)												
Say's Phoebe		2(L,T)		1(T)							1(T)		
Tree Swallow		2(F)				1(E)							
Barn Swallow	1(F)												
Gray Jay												2(F)	
Common Raven	3(F)					2(F)							
Boreal Chickadee	1(T)												
Ruby-crowned Kinglet	1(T)												
Hermit Thrush	1(T)										1(L)		
American Robin	2(E,L)					1(F)	2(L)			2(T)			
Bohemian Waxwing	3(E)				4(E)	4(E)							
Orange-crowned Warbler		1(E)											
Yellow Warbler	1(T)												
Yellow-rumped Warbler	2(F,T)	3(T)			1(T)	4(F,L,T)		1(F)			1(T)	1(F)	
Palm Warbler	1(T)								1(T)				
Chipping Sparrow										2(T)			
Savannah Sparrow						1(L)		1(T)	1(T)	1(T)			
Swamp Sparrow		1(L)											
White-throated Sparrow	1(T)												
White-crowned Sparrow	2(T)					1(E)							

Cont'd...

Table 1. Continued.

Species	Bullmoose Lake	Bullmoose Creek	Bud Lake	Alpha Lake	Beta Lake	Dodad Lake	Skeeter Lake	Skeeter Creek	Thin Lake	Sedge Lake	Airstrip Lake	Sand Lake	Tail End Lake
Sparrow sp.	2(F,T)					2(F)							
Dark-eyed Junco		2(E)								2(T)	4(E,T)		
Red-winged Blackbird	1(F)												
Common Redpoll						1(E)				1(T)			
Passerine sp.	1(F)	1(F)	1(F)						2(F)				
Total species	29	10	5	3	2	22	1	2	5	10	9	8	4
Total Individuals	68	17	11	6	5	85	7	2	13	24	31	17	7

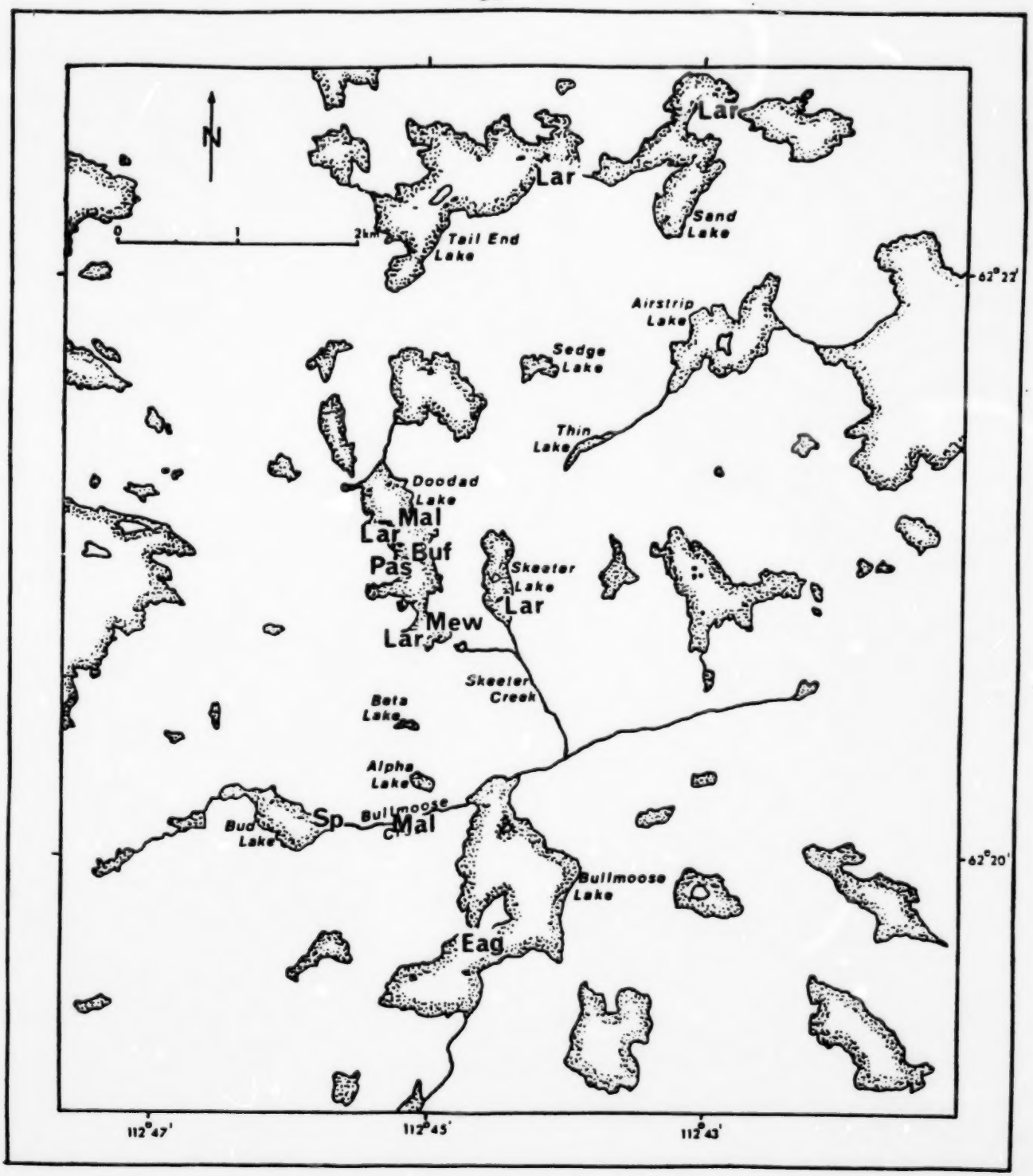

Figure 4. Locations of nests found in May and August, 1984.

Buf - Bufflehead (unoccupied)
Eag - Bald Eagle
Lar - Larid (unoccupied)
Mal - Mallard
Mew - Mew Gull
Pas - Passerine (unoccupied)
Sp - Species unknown (unoccupied)

Table 2. Number of nests and eggs located in May and August, 1984.

Species	No. of Nests	No. of Eggs
Mallard	2	8,10
Bufflehead	1	0
Bald Eagle	1	2
Mew Gull	1	1
Unidentified Larid*	5	unknown
Unidentified passerine	1	from previous year
Unidentified sp.*	1	unknown

* located during the August survey.

Table 3. Number of broods and age of young observed in August, 1984.

Species	No. of Broods	No. of Young	Age of Young
Horned Grebe+	1	3	3-IIA
Scaup+	3	11	8-IC, 3IIA
Surf Scoter	10	38	18-IIA, 9-IIB, 8-IIC, 3-III
Bald Eagle	1	2	fully feathered

* according to Gollop and Marshall (1954).

+ located outside the study area (Fig. 5).

Table 4. Abundance and activities of species observed in August, 1981.*

* Activities were designated as: B-brood rearing, E-feeding, F-flying, L-loafing

Species	Bullmoose Lake	Bullmoose Creek	Bud Lake	Alpha Lake	Beta Lake	Doodad Lake	Skeeter Lake	Skeeter Creek	Thin Lake	Sedge Lake	Airstrip Lake	Sand Lake	Tail End Lake
Common Loon	2(E)		2(E)			2(L)							1(F)
Mallard	6(L)	1(L)											
Scaup sp.						11(B,L)							
Surf Scoter	2(F,L)					14(B)	9(B)		4(B)		16(B,L)		4(B)
Red-breasted Merganser												1(L)	1(L)
Bald Eagle	3(B)												
American Kestrel						4(F)		2(F)			1(E)		
Spruce Grouse										1(E)			
Spotted Sandpiper	1(F)											1(E)	1(E)
Least Sandpiper								2(E)					
Herring Gull						1(F)							
Common Nighthawk	1(E)												
Say's Phoebe		1(L)											
Barn Swallow		2(E)											
Gray Jay										4(F)		3(F)	1(L)
Bohemian Waxwing										1(F)			
Yellow Warbler		1(F)											
Yellow-rumped Warbler		1(F)											
Chipping Sparrow		1(E)											
Swamp Sparrow		1(F)											
Sparrow sp.													1(L)
Dark-eyed Junco			1(E)							4(F)			
Common Redpoll											1(L)		
Passerine sp.		1(L)											1(F)
Total Species	6	7	2	0	0	5	1	2	1	4	3	3	5
Total Individuals	15	9	3	0	0	32	9	4	4	10	18	5	10

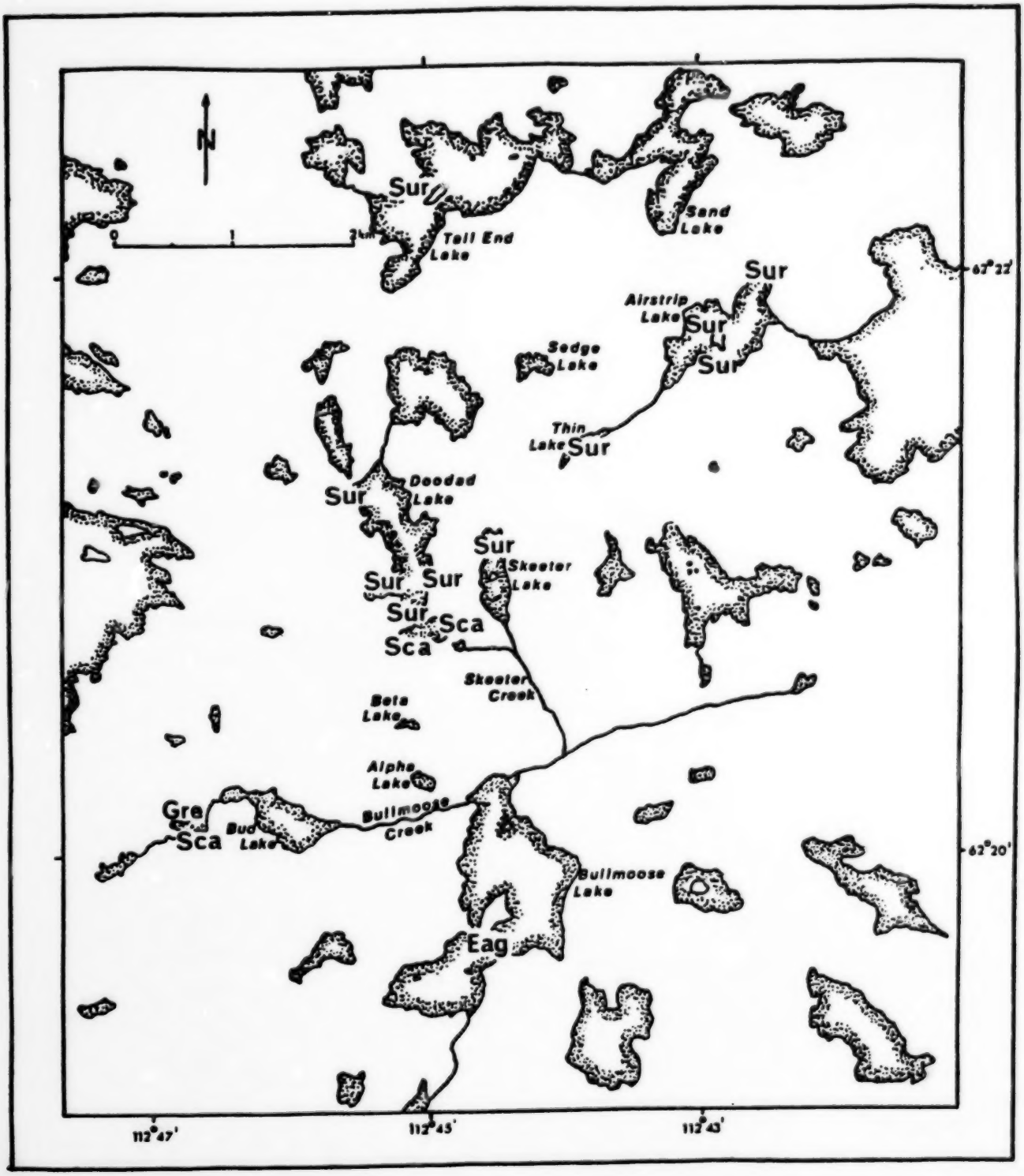

Figure 5. Brood sightings in August, 1984

Eag - Bald Eagle eyrie
Gre - Horned Grebe
Sca - Scaup
Sur - Surf Scoter

Murdy (1964) found peak migration in the Yellowknife area to occur in mid-May, and that dabbling ducks preceeded diving ducks, by two to three weeks in timing of migration and breeding. Our observations of nesting dabblers and scattered migrant diving ducks indicated that peak migration had passed. Therefore, the number of waterfowl observed may not be indicative of the area during peak migration. However, large concentrations of staging waterfowl are unlikely to occur within the study area. Northward migrating geese and ducks concentrate in the Mackenzie Valley, 150 km west of the area (Bellrose 1976), and occasionally at the mouth of the Beaulieu River where there is considerable open water during early spring. The relatively uniform habitat of poorly drained, rocky lakes within the study area, is not as attractive as areas of open water on river systems, or large productive marshes with extensive stands of Typha and Carex.

5.2 Breeding Birds

As the survey was conducted over several days, species movement between watercourses is likely to have occurred. Therefore the total number of individuals on the study area cannot be calculated. However, the frequency with which a species was observed serves as an index of abundance. Our results (Table 1 and 4) show that the majority of species are represented by less than ten individuals at each watercourse. This indicates a relatively low level of use.

Diving ducks, particularly Surf Scoter, were the primary users of the watercourses. Murdy (1964) found Lesser Scaup to be the most common nesting waterfowl in the Yellowknife area, in addition to American Wigeon, Green-winged Teal, and Mallards. Bromley and Trauger (n.d.) list Surf Scoter as being an occasional breeder in the Precambrian Shield north of Great Slave Lake. It is therefore of interest that 10 Surf Scoter broods formed the predominant waterfowl production on the study area.

One Mew Gull nest (in May) and five abandoned stick nests on rock islets (in August) indicate that larids breed within the study area. Based on size, location, and the absence of other species which build similar nests, the unoccupied nests are thought to be those of Mew Gulls. Allen and Ealey (1979) found Mew Gulls to be common but scattered nesters along the northeast shore of Great Slave Lake. Bromley and Trauger (n.d.) consider the Mew Gull to be a fairly common breeder in this region.

A Bald Eagle eyrie on Bullmoose Lake was the only raptor nest observed (Fig. 4). The large amount of nest material below the eyrie indicates that this site has been occupied for several years. The eyrie contained two eggs in May and two eaglets were present in August. As is customary, one eaglet was larger and dominant. It is not known if both eaglets fledged.

In May, the shallow bays of Bullmoose Lake contained large numbers of Northern Pike (Esox lucius). Northern Pike carcasses were found below the nest and on several islets near the eyrie. We therefore suspect that Bullmoose Lake supplied a major part of the eaglets' food requirements.

An unoccupied nest located under a rock overhang at the edge of Bud Lake (Fig. 4) was believed to be that of a Belted Kingfisher. In May, a female Kingfisher was observed nearby, and in August, whitewash, indicating recent use, was present at the site.

Based on observations of courtship or territorial behaviour, other suspected nesting species are: Common Loon, Lesser Scaup, Killdeer, Lesser Yellowlegs, Bonaparte's Gull, Northern Flicker, Say's Phoebe, Boreal Chickadee, Ruby-crowned Kinglet, Hermit Thrush, American Robin, Yellow Warbler, Yellow-rumped Warbler, Palm Warbler, Chipping Sparrow, Savannah Sparrow, White-throated Sparrow, White-crowned Sparrow, Dark-eyed Junco, and Common Redpoll. All of these species were represented by only a few individuals. This is, at least, partially due to the emphasis of our survey on waterbodies.

5.3 Anticipated Impacts

The importance of a particular site is a function of the portion of a population which it supports for any segment of the species annual cycle. In general, populations which are geographically widespread or dispersed widely throughout a variety of habitats are less vulnerable to site-specific threats than populations which are concentrated for any part of the year or occupy habitat of a restricted geographic area (McCormick et al. 1984). Therefore, this project was evaluated on the basis of its potential impact on bird populations.

In this study, 14 of the 25 breeding birds were found on Doodad and Skeeter lakes which will receive tailings. Due to the size of this mine and the abundance of breeding and feeding habitat in this area, special mitigative measures to deter birds from the tailing ponds is not practical.

Fate of the Bald Eagle nest is cause for concern. Bald eagles are common nesters in this area. Allen and Ealey (1979) found 24 active nests in the Yellowknife area and 39 nests in the east arm of Great Slave Lake, however, continental populations have been declining (Godfrey 1966). Heavy metals found in gold mine tailings have relatively high toxicity and accumulate in aquatic organisms, including fish (Wallace et al. 1975). With the addition of tailings to Doodad and Skeeter lakes and the threat of spills and seepage into Bullmoose Lake, fish from these lakes could become acutely toxic. They would then be easy prey for Bald Eagles since most fish that they take are dead or dying (Bent 1961).

The mine proposal includes the draining of Doodad and Skeeter lakes. A reasonable mitigative measure is to drain the lakes in early fall, thereby avoiding the loss of waterfowl broods. Complete draining of the lakes would also eliminate aquatic life which would otherwise accumulate toxins and be preyed upon by bottom feeding waterfowl and other fish-eating birds.

The infilling of lakes associated with airstrip construction could have an effect on the local water regime. The natural flow of water should be maintained so that associated wetlands are not destroyed.

Most species observed within the study area are common and widely distributed across Canada and will not be significantly affected by mining activities of the proposed mine. However, one might anticipate some displacement of indivdual pairs to areas away from the mine site.

SUMMARY AND RECOMMENDATIONS

At least 54 species occur within the study area and there is evidence indicating that 26 species are local breeders. No species was found in large numbers, and the area is not believed to be critical to any bird population. The amount and quality of the habitat necessary to support large numbers of nesting or staging migratory birds does not exist at the mine site.

In light of our findings, the following recommendations are made:

1) Land-use regulations should be strictly observed.

2) Doodad and Skeeter lakes should be drained in late September or October.

3) The Bald Eagle nest on Bullmoose Lake should be monitored over the life of the mine and the information provided to the Canadian Wildlife Service, Yellowknife.

7.0 LITERATURE CITED

Allen, D.L. and D.M. Ealey. 1979. Raptors and colonial birds of the Yellowknife area and East Arm of Great Slave Lake, N.W.T. Unpubl. Rept. Can. Wildl. Serv., Edmonton. 58 pp.

Atmospheric Environment Service. 1982a. Canadian climate normals, 1951-1980. Vol. 2 - Temperature. Downsview, Ontario. 306 pp.

Atmospheric Environment Service. 1982b. Canadian climate normals, 1951-1980. Vol. 3 - Precipitation. Downsview, Ontario. 602 pp.

Bellrose, F.C. 1976. Ducks, geese, and swans of North America. Stackpole Books, Harrisburg, Pa. 544 pp.

Bent, A.C. 1961. Life histories of North American birds of prey, Part 1. Dover Publications Inc., New York. 409 pp.

Bostock, H.S. 1970. Physiographic subdivisions of Canada. Pp. 11-30 In: R.J.W. Douglas (Ed.). Geology and Economic Minerals of Canada. Econ. Geol. Rept. No. 1, Geol Surv. Can., Ottawa.

Bromley, R.G. and L. Trauger. n.d. Birds of Yellowknife, a regional checklist. Unpubl. Rept., Yellowknife. 12 pp.

Dzubin, A. 1984. A partially annotated bibliography of disturbance, noise, and harrassment effects on birds. Unpubl. Rept., Can. Wildl. Serv., Saskatoon. 337 pp.

Falk, M.R., M.D. Miller, and S.J.M. Kostiuk. 1973. Biological effects of mining wastes in the Northwest Territories. Tech. Rept., Ser. No. CEN/T-73-10, Fish. and Mar. Serv., Winnipeg. 89 pp.

Fyfe, R.W. and R.R. Olendorff. 1976. Minimizing the dangers of nesting studies to raptors and other sensitive species. Occ. Paper No. 23, Can. Wildl. Serv., Edmonton. 17 pp.

Godfrey, W.E. 1966. The birds of Canada. Bull. No. 203, Biol. Ser. No. 73, Nat. Mus. Can., Ottawa. 428 pp.

Gollop, J.B. and W.H. Marshall. 1954. A guide for aging duck broods in the field. Miss. Flyway Counc. Tech. Sect. 14 pp.

McCormick, K.J., M.E. Adams, C.J. Stephenson, and A.S. Goodman. 1984. Key migratory bird terrestrial habitat sites in the Northwest Territories. Tech. Rept. No.84-6, Can. Wildl. Serv., Yellowknife. 175 pp.

Moore, J.W., D.J. Sutherland, S.J. Wheeler, and V.A. Beaubien. 1978. The effects of abandoned metal mines on aquatic ecosystems in the Northwest Territories. I. Discovery Mine. Rept. EPS-5-NW-78-7. Env. Prot. Serv., Yellowknife. 75 pp.

Murdy, H.W. 1964. Population dynamics and breeding biology of waterfowl in the Yellowknife study area, N.W.T. Unpubl. Rept., U.S. Fish and Wildl. Serv., Jamestown. 61 pp.

Nicholas, S.A. 1984. Initial environmental evaluation of Bullmoose Lake mine, N.W.T., Draft No. 1. Terra Mines Ltd., Edmonton. 92 pp.

Peakall, D.B. 1976. The Peregrine Falcon (Falco peregrinus) and pesticides. Can. Field-Nat. 90(3):301-307.

Thieret, J.W. 1964. Botanical survey along the Yellowknife highway, Northwest Territories, Canada. II. Vegetation. Sida 1(4):187-239.

Wallace, R.R., M.J. Hardin, and R.H. Weir. 1975. Toxic properties and chemical characteristics of mining effluents in the Northwest Territories. Rept. EPS-5-NW-75-4., Env. Prot. Serv., Yellowknife. 37 pp.

Appendix 1. Bird species observed within the study area.

Common Name	Scientific Name
Common Loon	*Gavia immer*
Arctic Loon	*Gavia arctica*
Red-necked Grebe	*Podiceps grisegena*
Horned Grebe	*Podiceps auritus*
Tundra Swan	*Cygnus columbianus*
Green-winged Teal	*Anas crecca*
Mallard	*Anas platyrhynchos*
American Wigeon	*Anas americana*
Ring-necked Duck	*Aythya collaris*
Greater Scaup	*Aythya marila*
Lesser Scaup	*Aythya affinis*
Oldsquaw	*Clangula hyemalis*
Surf Scoter	*Melanitta perspicillata*
White-winged Scoter	*Melanitta fusca*
Bufflehead	*Bucephala albeola*
Red-breasted Merganser	*Mergus serrator*
Bald Eagle	*Haliaeetus leucocephalus*
Northern Harrier	*Circus cyaneus*
American Kestrel	*Falco sparverius*
Merlin	*Falco columbarius*
Spruce Grouse	*Dendragapus canadensis*
Killdeer	*Charadrius vociferus*
Lesser Yellowlegs	*Tringa flavipes*
Spotted Sandpiper	*Actitis macularia*
Least Sandpiper	*Calidris minutilla*
Bonaparte's Gull	*Larus philadelphia*
Mew Gull	*Larus canus*
Herring Gull	*Larus argentatus*
Arctic Tern	*Sterna paradisaea*
Common Nighthawk	*Chordeiles minor*

Appendix 1. Continued.

Belted Kingfisher	*Ceryle alcyon*
Northern Flicker	*Colaptes auratus*
Say's Phoebe	*Sayornis saya*
Tree Swallow	*Tachycineta bicolor*
Barn Swallow	*Hirundo rustica*
Gray Jay	*Perisoreus canadensis*
Common Raven	*Corvus corax*
Boreal Chickadee	*Parus hudsonicus*
Ruby-crowned Kinglet	*Regulus calendula*
Hermit Thrush	*Catharus guttatus*
American Robin	*Turdus migratorius*
Bohemian Waxwing	*Bombycilla garrulus*
Orange-crowned Warbler	*Vermivora celata*
Yellow Warbler	*Dendroica petechia*
Yellow-rumped Warbler	*Dendroica coronata*
Palm Warbler	*Dendroica palmarum*
Chipping Sparrow	*Spizella passerina*
Savannah Sparrow	*Passerculus sandwichensis*
Swamp Sparrow	*Melospiza georgiana*
White-throated Sparrow	*Zonotrichia albicollis*
White-crowned Sparrow	*Zonotrichia leucophrys*
Dark-eyed Junco	*Junco hyemalis*
Red-winged Blackbird	*Agelaius phoeniceus*
Common Redpoll	*Carduelis flammea*